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Three New Buccinid Species (Gastropoda: Neogastropoda) from Chilean Deep-Water, Including One from a Methane Seep

KOEN FRAUSSEN

Leuvensestraat 25, B-3200 Aarschot, Belgium
(e-mail: koen.fraussen@skynet.be)

JAVIER SELLANES

Universidad Católica del Norte, Facultad de Ciencias del Mar, Larrondo 1281, Coquimbo, Chile
(e-mail: sellanes@ucn.cl)
Centro de Investigación Oceanográfica en el Pacífico Sur-Oriental (COPAS), Universidad de Concepción, Casilla 160-C, Concepción, Chile

Abstract. Three deep water species from off the Chilean coast are described as new. *Aeneator prognaviter* sp. nov. (off Antofagasta) is compared with *A. loisae* Rehder, 1971 and *A. castillai* McLean & Andrade, 1982. The peculiar *Aeneator portentosus* sp. nov. (off Coquimbo) has the generic placement based on conchological characteristics and is compared with *Americominella duartei* Klappenbach & Ureta, 1972. *Kryptos explorator* sp. nov. (off Concepción) is compared with *K. koehleri* (Locard, 1896), the generic placement based on conchological characteristics (protoconch and slightly broader peripheral spiral interspace) and radular morphology. *Kryptos explorator* sp. nov. has been collected at a recently discovered methane seep area off Concepción (~36°S), but its degree of association to seep fauna is still uncertain.

Key Words: Gastropoda, Buccinidae, *Aeneator*, *Kryptos*, new taxa, methane-seeps, bio-diversity, East Pacific, Chile.

INTRODUCTION

The coastal zone off north to south-central Chile, strongly influenced by wind-driven upwelling, is one of the areas with the highest known primary production rates worldwide (Daneri et al., 2000). Consequently this area of the south-eastern Pacific Ocean harbours a vast pelagic and benthic biomass. However, in spite that the benthic fauna has been proven to be rich in endemic species, of which many are still undescribed or unknown, its scarce knowledge still precludes researchers have an accurate assessment of the diversity along the Chilean margin.

The existing literature on benthic communities along the continental margin off north to south-central Chile is restricted mostly to the shelf and upper slope (e.g., Gallardo, 1963; Brattström & Johanssen, 1983). Except for the general results of the R/V Anton Bruun cruise in the Southern Pacific (Garth & Haig, 1971; Menzies et al., 1973), the Russian Expeditions (Mironov & Rudjakov, 1990, and references therein) and general studies of the archibenthal fauna (Andrade, 1986, 1987), there are no detailed studies on bathyal benthic communities.

Regarding mollusks, the offshore continental slope and the deep ocean floor were also largely underestimated in the past, if not miserably ignored by collectors and malacologists. Today we know that the Chilean coastline and adjacent continental slope harbors many species of molluscs. The result of continuous research conducted by scientific expeditions (from the Lund University Chile Expedition in 1948–1949 to the PUCK-156 expedition in 2001, to mention a few), by local trawlers (McLean & Andrade, 1982) and from shrimpers of the former Soviet Union (Fraussen & Hadorn, 2000; Poupin, 2003), have produced noteworthy contributions. Most recently, the existence of methane seepage and associated chemosynthetic communities in the bathyal zone off central Chile (Concepción Methane Seep area or CMSA, Sellanes & Krylova, 2005) has been reported, and sampling has brought to light many new bathyal species. Some of the associated chemosymbiotic bivalves found (e.g., *Calyptogena*, *Lucinoma* and *Thyasira* have recently been described (Holmes et al., 2005; Oliver & Sellanes, 2005; Sellanes & Krylova, 2005). New species of gastropods have been named (e.g., *Trophon concepcionensis*, Houart and Sellanes, 2006; *Otukaia crustulum* and *Margarites huloti*, Vilvens and Sellanes, 2006). In the present article we add to this list a new buccinid species from this seep area as well as two new species from the north to central Chile margin.

The goal of the present paper is thus to contribute to

the knowledge of the family Buccinidae from north to south-central Chile and to continue the effort of describing the malacofauna of the CMSA

ABBREVIATIONS

AGT	Agassiz trawl
CMSA	Concepción Methane Seep Area
JS	collection of Javier Sellanes, Chile
KF	collection of Koen Fraussen, Belgium
MNHN	Muséum National d'Histoire Naturelle, Paris, France
MNHNCL	Museo Nacional de Historia Natural, Santiago, Chile.
lv	live collected specimen
dd	empty shell

SYSTEMATICS

Class: Gastropoda Cuvier, 1797
Order: Neogastropoda Wenz, 1938
Subfamily: Buccinoidea Rafinesque, 1815
Family: **Buccinidae** Rafinesque, 1815
Genus: *Aeneator* Finlay, 1927:414.

Type species. Verconella marshalli Murdoch, 1924 (by original designation). Fossil, Tertiary, New Zealand.

Definition. The genus *Aeneator* is present mainly in the West Pacific, with the geographical center situated around New Zealand, and with an important fauna off southern West America. For an overview of the genus off New Zealand, we refer to Powell (1979:201–203).

Here we follow the opinion of McLean & Andrade (1982:12–13) and use *Aeneator* in a broad sense, without subgeneric splitting for the Chilean species.

Three species were previously known from Chilean waters: *Aeneator fontainei* (d' Orbigny, 1839), *Aeneator* (*Ellicea*) *loisae* Rehder, 1971 and *Aeneator castillai* McLean & Andrade, 1982.

Aeneator prognaviter new species

(Figures 1–2, 12–15)

Type material. Holotype (MNHNCL-5863) (32.2 mm), Chile, off Antofagasta 22°51′99 S, 70°29′40 W, in 318 m, lv.

Paratype 1 (KF-5178) (26.0 mm), same locality as holotype, lv; paratype 2 (MNHNCL-5864) (29.2 mm), same locality as holotype, dd.

Type locality. Chile, north of Antofagasta, Chilean upper continental slope, in 318 m.

Range and habitat. Only known from the type material.

Description. Shell small for genus (up to 32.2 mm), thick, solid, snow white. Shape broad with moderately high spire, whorls convex, slightly angulate, suture deep.

Upper whorls and protoconch eroded, about 4 1/2 teleoconch whorls remaining of which only 3 1/2 with sculpture intact.

Spire whorls with 8 or 9 broad spiral cords with rather sharp top, interspaces broad, of equal size. Body whorl with 20–24 spiral cords, occasionally alternating fine and sharp.

Spire whorls with 17–19 pronounced, slightly curved axial ribs, interspaces deep, broad. Body whorl with 22 such axial cords, gradually becoming weaker towards outer lip.

Aperture oval, columella smooth, slightly curved, outer lip thin, simple, edge sharp. Siphonal canal short, broad, open.

Operculum small, thin, transparent, yellowish brown, elongate, nucleus terminal, tip sharp.

Comparison. Aeneator prognaviter sp. nov. is characterized by broad shape with angular whorls, curved axial ribs and short siphonal canal.

Aeneator loisae Rehder, 1971 and *A. castillai* McLean & Andrade, 1982 both differ in having a higher number of spiral cords in combination with a lower number of axial ribs, spiral cords with a convex top (instead of sharp) and usually a higher number of secondary spiral cords (instead of alternating fine and strong), axial ribs which are straight (instead of bent and curved) and a larger adult size.

Aeneator recens (Dell, 1951) from New Zealand is somewhat similar in shape, axial sculpture, size and colour but differs by having narrower spiral cords with broader interspaces, a longer siphonal canal and a curved operculum.

Etymology. Aeneator prognaviter sp. nov. is named after the Latin expression "prognaviter," meaning "clearly" and "brief and to the point" or "short but sweet" (as adverbum), or meaning "also" (as substantivum), which refers to the shell which is clearly an *Aeneator*. It also refers to the small size (short or brief) but still an *Aeneator* (to the point).

Aeneator portentosus new species

(Figures 3–4, 7–11)

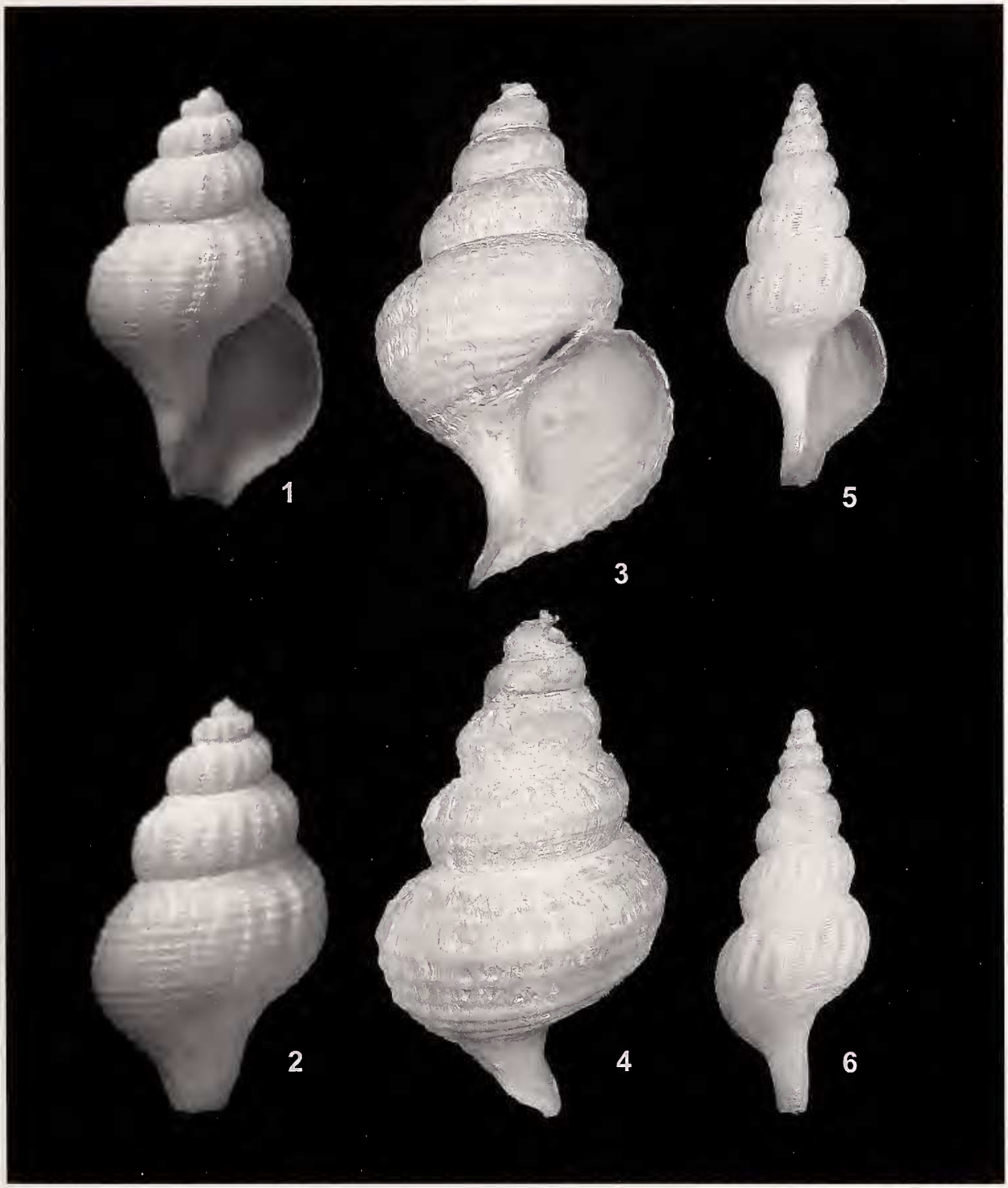
Type material. Holotype (MNHNCL-5865) (44.9 mm, siphonal canal broken), Chile, continental slope off Iquique, 21°19′ S, 70°26′ W, in 605 m, dd.

Paratype (KF-0338) (45.5 mm), off Coquimbo, 800 m deep, trawled by fisherman.

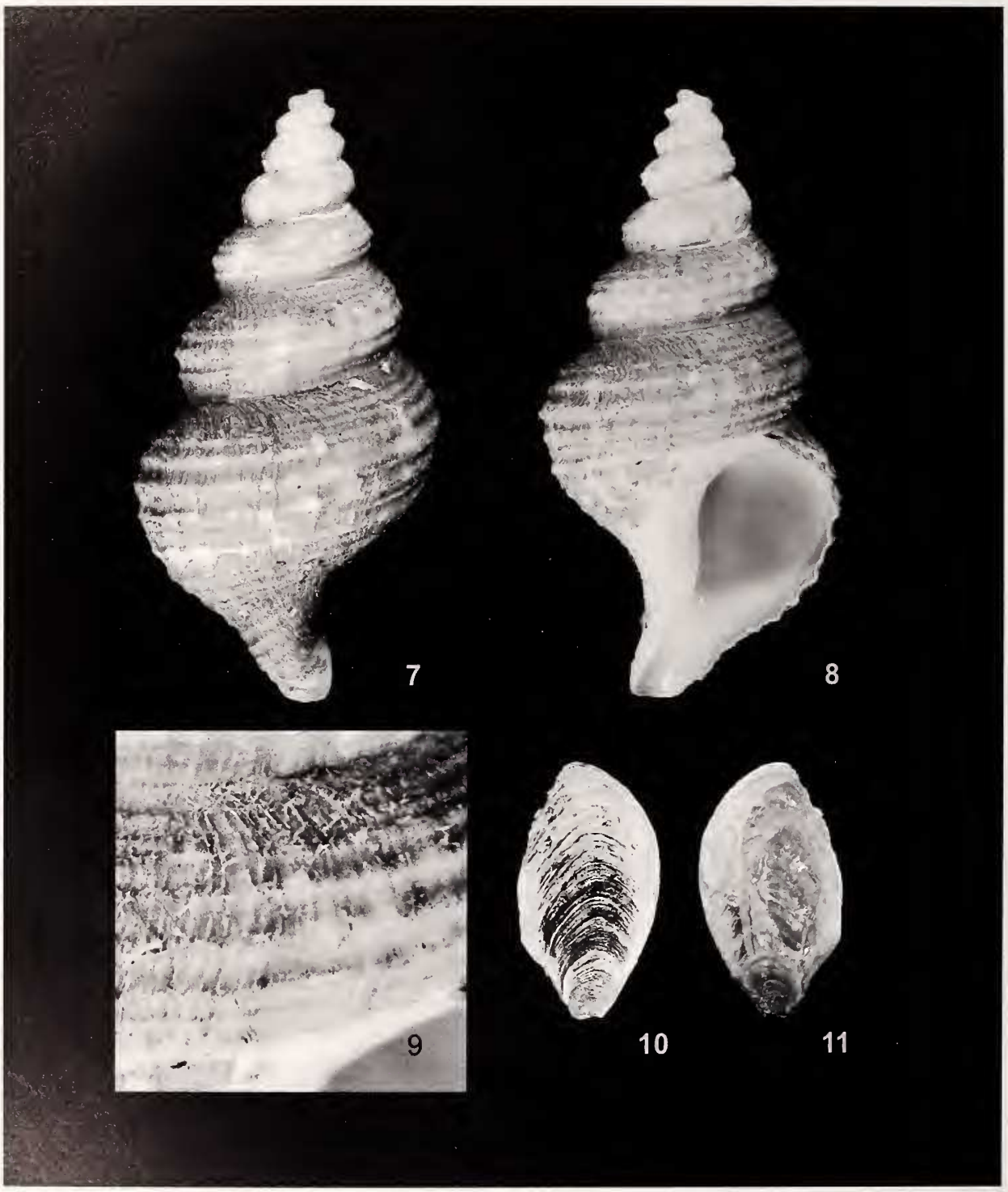
Type locality. Chile, off Iquique, 21°19′ S, 70°26′ W, in 605 m.

Range and habitat. Only known from the type material.

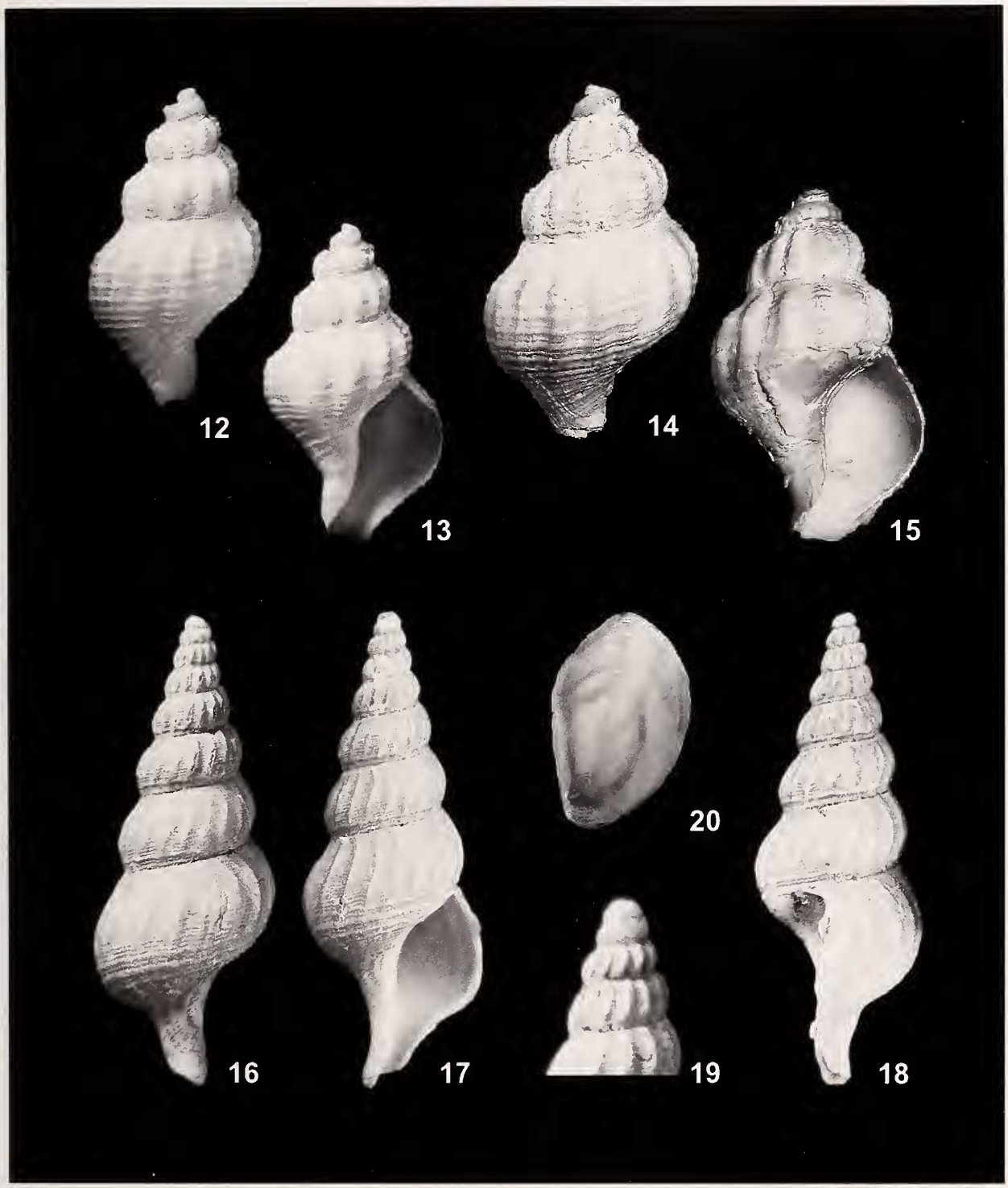
Description. Shell medium (up to 45.5 mm), thin but solid, snow white. Shape elongate with high spire. Whorls angulate, upper spire whorls rather pagodoid. Spiral sculpture dominant.



Figures 1–2. *Aeneator prognaviter* sp. nov., holotype, 32.2 mm, Chile, off Antofagasta 22°51′99 S, 70°29′40 W, 318 m, MNHNCL-5863.
Figures 3–4. *Aeneator portentosus* sp. nov., holotype, 44.9 mm, Chile, off Iquique 21°19S, 70°26W, 605 m,, MNHNCL-5865.
Figures 5–6. *Kryptos explorator* sp. nov., holotype, 29.6 mm, Chile, northwest of the Bay of Concepción 36°20′97 S, 73°44′86 W, 850 m, MNHNCL-5866.



Figures 7–11. *Aeneator portentosus* sp. nov., paratype, 45.5 mm, Chile, off Coquimbo, 800 m, KF-0338.



Figures 12–13. *Aeneator prognaviter* sp. nov., paratype 1, 26.0 mm, Chile, off Antofagasta 22°51′99 S, 70°29′40 W, 318 m, KF-5178.
Figures 14–15. *Aeneator prognaviter* sp. nov., paratype 2, 29.2 mm, Chile, off Antofagasta 22°51′99 S, 70°29′40 W, 318 m, MNHNCL-5864.
Figures 16–20. *Kryptos explorator* sp. nov., 16–19. paratype 3, 28.9 mm, Chile, northwest of the Bay of Concepción 36°22′68 S, 73°42′46 W, 708–709 m, KF-5180. 20. operculum of holotype, 6.6 mm.

Upper whorls and protoconch eroded.

All whorls with 6 or 7 sharp spiral cords, subsutural cord weak, gradually stronger along subsutural slope, pronounced on periphery, forming a carina. Interspaces broad, bottom weakly concave. Body whorl with about 20 spiral cords, 3 or 4 weak ones on subsutural slope, 2 or 3 strong ones on periphery, gradually becoming slightly weaker towards siphonal canal.

Upper spire whorls eroded but numerous fine axial ribs still traceable, more pronounced on periphery and on top of spiral cords. Axial ribs gradually weaker towards penultimate whorl. Body whorl smooth. All whorls covered by fine incremental lines.

Aperture round, columella smooth, slightly curved, outer lip thin, simple, edge sharp. Siphonal canal moderately short, broad, open, slightly bent.

Periostracum (paratype 1) thick, ornamented with a dense sculpture of fine, sharp axial lamellae, running from suture to suture, forming sharp spines or hairs on transition with spiral sculpture.

Operculum small, thin, corneous, dark brown, elongate, nucleus terminal, tip sharp.

Comparison. Aeneator portentosus sp. nov. is characterized by the rather pagodoid shape, the pronounced spiral sculpture and the densely sculptured periostracum.

The generic placement is based on conchological characteristics and on the shape of the operculum.

All *Aeneator* species known from Chile differ by having more convex whorls, a slightly longer siphonal canal, narrower spiral interspaces and a smoother periostracum.

Etymology. Aeneator portentosus sp. nov. is derived from the Latin expression *portentosus* (adjective), meaning "wonderful," which refers to the graceful shape and excellent sculpture.

Genus ***Kryptos*** Jeffreys in Dautzenberg & Fischer, 1896

Type species. Kryptos elegans Jeffreys in Dautzenberg & Fischer, 1896 (type locality: "bathyal, W. of Spain" designated by Bouchet & Warén, 1985:196), by monotypy, a junior synonym of *Pleurotomella koehleri* Locard, 1896.

Transferred to Buccinidae by Bouchet & Warén (1985:195), based on morphology of the radula.

Range, until the present paper, restricted to the Atlantic Ocean, the two known species being *K. koehleri* (Locard, 1896) (= *Kryptos elegans* Jeffreys in Dautzenberg & Fischer, 1896; *Pleurotomella atlantica* Locard, 1897 and *Pleurotomella demulcata* Locard, 1897) from the N. E. Atlantic and *K. tholoides* (Watson, 1882) from the S. W. Atlantic (off Brazil).

Remarks. Kryptos is characterized by a multispiral, rather big protoconch with a slightly flattened tip, sculptured towards transition to the teleoconch (Figure 28), a smooth, narrow subsutural band, a slightly broader interspaces on the periphery, carinated whorls (type species) or sculptured with some sharp keels (*K. tholoides*). Bouchet & Warén (1985:196) noted that *K. koehleri* lack eyes.

Americominella Klappenbach & Ureta, 1972 (type species: *Americominella duartei* Klappenbach & Ureta, 1972) from the Patagonian continental shelf is similar in protoconch morphology and sculpture but differs by the radula, which has a tricuspid central tooth with broad base.

Kapala Ponder, 1982 (type species: *Kapala kengrahani* Ponder, 1982) from Australia has a radula with an identical central tooth but which differs by having the lateral teeth with 1 large outer cusp and more than 5 small inner cusps.

Antarctoneptunea Dell, 1972 (type species: *Fusitriton aurora* Hedley, 1916) is similar in shape but differs in having a large papilliform protoconch (similar to *Aeneator*) and a radula with tricuspid central tooth.

The new species described below is tentatively placed in *Kryptos* based on similarities in radula, protoconch and spiral sculpture.

Kryptos explorator new species

(Figures 5–6, 16–25)

Type material. Holotype (MNHNCL-5866) (29.6 mm), south-central Chile, R/V Vidal Gormáz (SeepOx cruise, AGT 6–7, 09/02/2006), CMSA, northwest of the Bay of Concepción 36°20′97 S, 73°44′86 W, 850 m, lv.

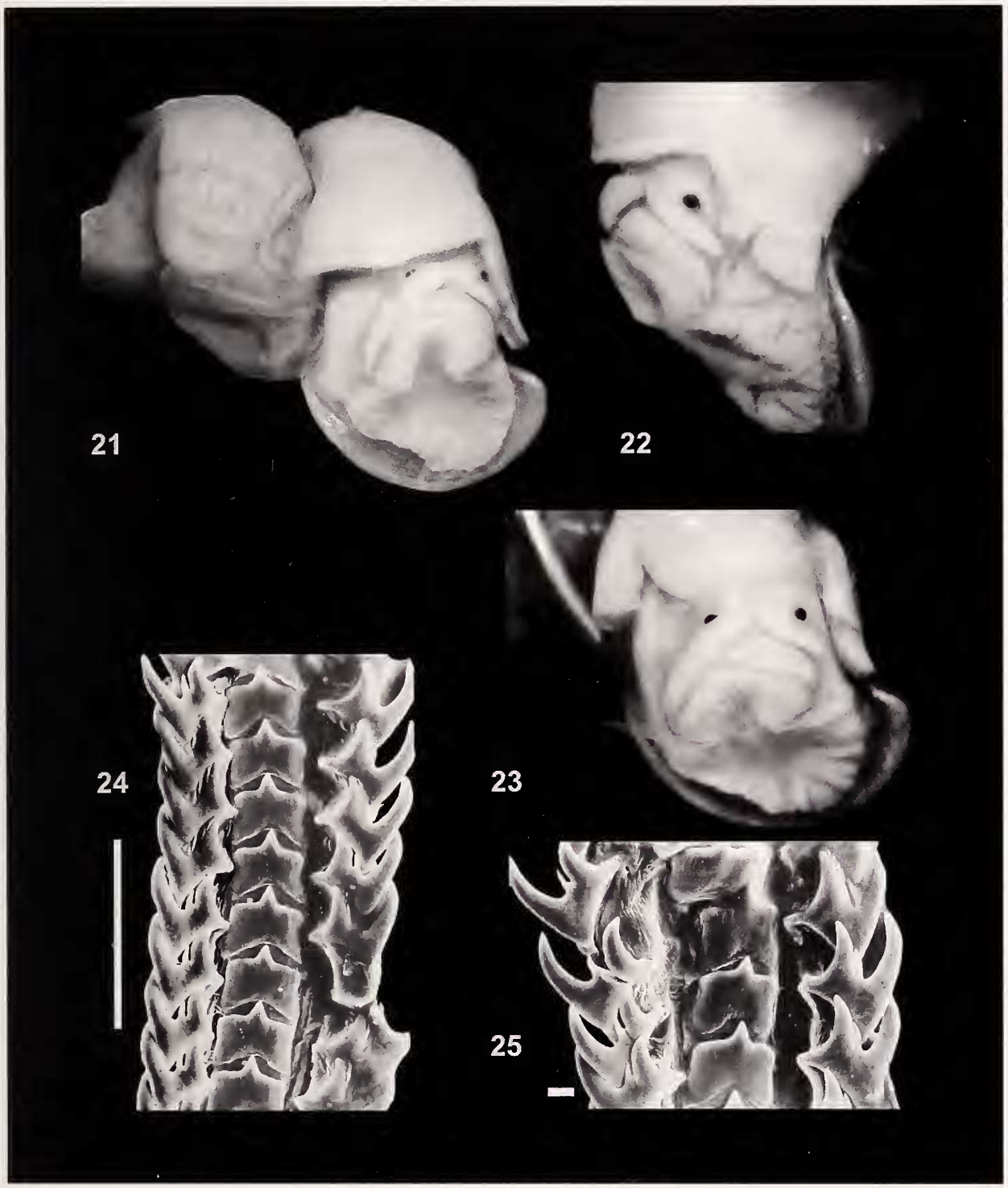
Paratype 1 (MNHNCL-5867) (29.4 mm), same locality as holotype, lv; paratype 2 (MNHNCL-5868) (29.3 mm), same locality as holotype, lv; paratypes 3 & 4 (KF-5180–5181) south-central Chile, R/V Vidal Gormáz (VG-04 Cruise, AGT 10, 10/14/2004), CMSA, northwest of the Bay of Concepción, 36°22′68 S, 73°42′46 W, 708–709 m; paratype 5 (MNHN-9961) same locality of paratypes 3 & 4.

Type locality. South-central Chile, R/V Vidal Gormáz (SeepOx Cruise, AGT 6–7, 09/02/2006), CMSA, northwest of the Bay of Concepción, 36°20′97 S, 73°44′86 W, 850 m.

Range and habitat. Only known from the type material. All the specimens of *K. explorator* sp. nov., so far collected have been associated with fauna typical of methane seeps (vesicomyid, solemyid, lucinid and thyasirid bivalves). However, the scarce knowledge of the bathyal SE Pacific malacofauna still prevents us from establishing if this new species lives in an obligate association with seep environments.

Description. Shell small (up to 29.6 mm), thin but solid, semi-transparent, white. Shape fusiform with slender spire.

Protoconch multispiral, consisting of about 2 1/4



Figures 21–25. *Kryptos explorator* sp. nov., holotype, Chile, northwest of the Bay of Concepción 36°20′97 S, 73°44′86 W, 850 m, MNHNCL-5866. 21. frontal view of removed animal. 22. left side view. 23. close up of the head showing the remarkable eyes. 24. radula, scalebar: 100 micrometer. 25. radula, scalebar: 10 micrometer.

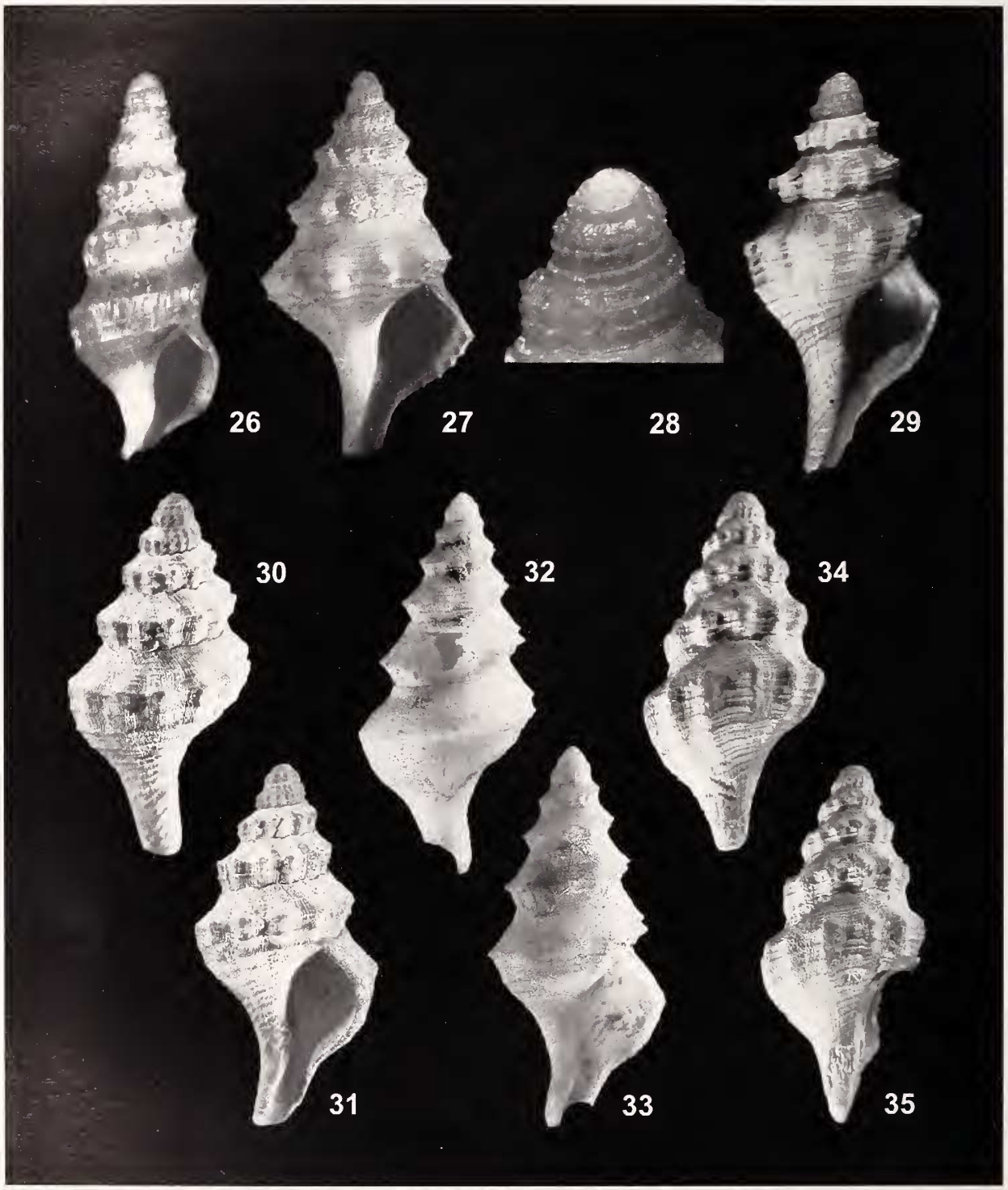


Figure 26. *Krypthos tholoides* (Watson, 1882), holotype, 16.1 mm, BMNH, after Bouchet & Warén, 1986, fig. 96.
Figures 27–35. *Kryptos koehleri* Locard, 1896. 27. 21.8 mm, Gulf of Biscay, BIOGAS CP25, 44°05′N, 04°17′W, 1894 m, after Bouchet & Warén, 1985, fig. 511. 28–29. 11.8 mm, off Portugal, after Bouchet & Warén, 1985, fig. 512. 30–31. holotype of *Pleurotomella elegans* Jeffreys in Dautzenberg & Fischer, 1896, 12.0 mm, MNHN-6422. 32–33. holotype of *Pleurotomella atlantica* Locard, 1897, 16.5 mm, MNHN-6647. 34–35. holotype of *Pleurotomella demulcata* Locard, 1897, 13.2 mm, MNHN-6645.

whorls, about 1.6 mm in diameter, tip flattened, last whorl rather big, convex, ornamented with a reticulate sculpture of 7 or 8 fine spiral cords and numerous fine axial lamellae. Sculpture appearing as small holes when slightly eroded (first protoconch whorl). Transition to teleoconch indistinct.

Teleoconch whorls up to 7 in number, convex, adapical part slightly flattened, accentuating a conical shape. Suture distinct.

First whorl with 7 spiral cords, at first smooth and weak, gradually becoming stronger and more convex, with deep interspaces of equal width. Second whorl with 8 sharp, narrow spiral cords, interspaces twice as broad. Spiral cords suddenly broader and weaker, but occasionally still sharp, with variable interspaces, usually narrow. Third whorl with 12 spiral cords of mixed strength. Body whorl adapically rather smooth, with numerous weak or obscure spiral cords; base strongly sculptured with about 9 strong spiral cords. Siphonal canal rather smooth with about 15 weak spiral cords.

First teleoconch whorl with fine axial riblets at beginning, gradually becoming stronger, waving on top of spiral cords, second whorl with pronounced, sharp, narrow axial ribs, slightly weaker near sutures. Second whorl with 13, third whorl with 14 such ribs. Penultimate and body whorl with 17 axial ribs on adapical half of body whorl, base smooth. All whorls covered with fine, slightly curved incremental lines.

Aperture round, columella gently curved, callus thin, smooth. Outer lip thin, sharp, laterally curved according to incremental lines. Siphonal canal narrow, rather short, open.

Operculum corneous, thin, pale brownish, elongate, nucleus terminal, tip sharp.

Periostracum yellowish to pale brown, thin, smooth, well adherent.

Radula (Figures 24–25) typical for genus: central tooth rather rectangular with concave base and 1 short cusp, lateral teeth tricuspid with large outer cusp and small middle cusp.

Animal (Figures 21–23) pale yellowish, with 2 short but broad tentacles and black, rather big eyes.

Comparison. Kryptos explorator sp. nov. is characterized by having a fusiform shape, a multispiral, rather big protoconch with a slightly flattened tip and a reticulate sculpture near the transition to teleoconch, a smooth, narrow subsutural interspace between suture and shoulder and slightly broader, smooth interspaces on the periphery.

K. koehleri (Locard, 1896) (Figures 27–35) differs by having a broad shape with strongly angulate whorls and by lacking eyes.

K. tholoides (Watson, 1882) (Figure 26) differs by having 2 strong spiral folds, broader interspaces and a glossy surface.

Etymology. Kryptos explorator sp. nov. is named after the Latin expression *explorator* (subst., m) meaning "a scout" or "the one who search out," which refers to the range (the Pacific, new for the genus and far from the Atlantic) where this new species is found. It also refers to the presence of eyes (to explore the new habitat visually) which are absent in the type species (*K. koehleri*).

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